

TECHNICAL SPECIFICATION

**Electric vehicle conductive charging system –
Part 3-1: DC EV supply equipment where protection relies on double or
reinforced insulation – General rules and requirements for stationary equipment**

IEC TS 61851-3-1:2023

<https://standards.iteh.ai/catalog/standards/sist/fae14196-dc2f-4386-9fc6-bb8f89b8bae7/iec-ts-61851-3-1-2023>



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 43.120

ISBN 978-2-8322-7073-8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 3-1: DC EV supply equipment where protection relies
on double or reinforced insulation – General rules
and requirements for stationary equipment**

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IEC TS 61851-3-1 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
69/845/DTS	69/882/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

In this document, the following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

A list of all parts in the IEC 61851 all parts, published under the general title *Electric vehicles conductive charging system*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This document is published in separate parts according to the following structure:

IEC TS 61851-3-1, *Electric vehicle conductive charging system – Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

IEC TS 61851-3-2, *Electric vehicle conductive charging system – Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment*

IEC TS 61851-3-4, *Electric vehicle conductive charging system – Part 3-4: DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

IEC TS 61851-3-5, *Electric vehicle conductive charging system – Part 3-5: DC EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*

IEC TS 61851-3-6, *Electric vehicle conductive charging system – Part 3-6: DC EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit communication*

IEC TS 61851-3-7, *Electric vehicle conductive charging system – Part 3-7: DC EV supply equipment where protection relies on double or reinforced insulation – Battery system communication*

[IEC TS 61851-3-1:2023](https://standards.iteh.ai/catalog/standards/sist/fae14196-dc2f-4386-9fc6-bb8f89b8bae7/iec-ts-61851-3-1-2023)

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment

1 Scope

This part of IEC 61851, which is a Technical Specification, applies to the equipment, including stationary equipment

- for the conductive transfer of electric power between the supply network and
 - an electric road vehicle, or
 - a removable rechargeable energy storage system (RESS), or
 - an on-board RESS of an electric road vehicle,
- when the equipment is connected to the supply network having a supply voltage up to 480 V AC or up to 400 V DC and a rated output voltage up to 120 V DC, and
- where the protection against electric shock relies on double or reinforced insulation, and with double or reinforced insulation between all AC and DC inputs and outputs.

NOTE 1 In the following countries, the acceptable nominal supply voltage is up to 600 V AC: CA, US.

Particular requirements for portable and mobile DRI EV supply equipment are covered by IEC TS 61851-3-2023.

Equipment for the conductive transfer of electric power between the supply network and an electric road vehicle/RESS according to the IEC TS 61851-3 series is intended to be connected to vehicles where the vehicle power supply circuit is protected against electric shock by double or reinforced insulation.

NOTE 2 For information regarding protection against electric shock by double or reinforced insulation of the EV or of the vehicle power supply circuit, see ISO 18246:2023, 6.1.1 b) and Table 3.

Requirements for bidirectional energy transfer DC to AC are under consideration and are not part of this document.

This document also applies to EV supply equipment supplied from on-site storage systems (e.g. buffer batteries).

This document applies to VCU's intended to be a part of DRI EV supply equipment specified in this document.

This document applies to equipment for the conductive transfer of electric power between the supply network and an electric road vehicle/RESS intended to be installed and/or used at an altitude of up to 2 000 m.

The aspects covered in this document include

- the connection to the vehicle,
- characteristics to be complied with by the vehicle with respect to the AC or DC,
- the specification for required level of electrical safety for the double or reinforced insulated (DRI) EV supply equipment,

- operators and third-party electrical safety,
- requirements for command and control communication for safety and process matters, if required,
- requirements for bidirectional power transfer DC to DC, and
- the connection to installations according to IEC 60364-7-722.

NOTE 3 In the following countries, electrical installation codes other than those from IEC 60364-7-722 are used: CA, US.

Equipment covered by this document is not intended to be located in hazardous areas where flammable gas or vapour and/or combustible materials, fuels or other combustible or explosive materials are present. Additional requirements can apply to these locations.

This document does not apply to

- aspects related to maintenance,
- electrical devices and components, which are covered by their specific product standards,
- trolley buses and rail vehicles,
- vehicle power supply circuit, which is covered by ISO 18246, and
- EMC requirements for on-board equipment while connected to the supply, which are covered by IEC 61851-21-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

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IEC 60038, *IEC standard voltages*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-11:2021, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60269 (all parts), *Low-voltage fuses*

IEC 60309-2:2021, *Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes – Part 2: Dimensional compatibility requirements for pin and contact-tube accessories*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60335-1:2020, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-41:2005/AMD1:2017

IEC 60364-7-722:2018, *Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60884-1:2022, *Plugs and socket-outlets for household and similar purposes – Part 2: General requirements*

IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60898-1, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3:2020, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-4-1:2018, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-6-2, *Low-voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*
IEC 60950-1:2005/AMD1:2009
IEC 60950-1:2005/AMD2:2013

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

IEC 61009-1:2010, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

IEC 61009-1:2010/AMD1:2012

IEC 61009-1:2010/AMD2:2013

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61439-7:2022, *Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicles charging stations*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications*

IEC 61810-1, *Electromechanical elementary relays – Part 1: General and safety requirements*

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-3 (all parts), *Electric vehicle conductive charging system – Part 3: DC EV supply equipment where protection relies on double or reinforced insulation*

IEC TS 61851-3-2:2023, *Electric vehicle conductive charging system – Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment*

IEC TS 61851-3-4:2023, *Electric vehicle conductive charging system – Part 3-4: DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

IEC TS 61851-3-5:2023, *Electric vehicle conductive charging system – Part 3-5: DC EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62196-1:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements*

IEC TS 62196-4:2022, *Plugs, socket-outlets, vehicle connectors and vehicles inlets – Conductive charging of electric vehicles – Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for class II or class III applications*

IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC PAS 62840-3:2021, *Electric vehicle battery swap system – Part 3: Particular safety and interoperability requirements for battery swap systems operating with removable RESS/battery systems*

ISO 11898-1:2015, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

EN 50325-4:2002, *Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 4: CANopen*

EN 50604-1:2016, *Secondary lithium batteries for light EV (electric vehicle) applications – Part 1: General safety requirements and test methods*
EN 50604-1:2016/AMD1:2021

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61851-1:2017, IEC TS 61851-3-4:2023 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Electric supply equipment

3.1.1

double or reinforced insulated EV supply equipment

DRI EV supply equipment

class II EV supply equipment

EV supply equipment in which protection against electric shock relies on double insulation or reinforced insulation, there being no provision for protective earthing or reliance upon installation conditions.

Note 1 to entry: DRI EV supply equipment intended to use in case C includes supply cable and vehicle connector.

Note 2 to entry: IEC 61851-1:2017, 3.1.1, Examples 1 and 2, are not applicable.

Note 3 to entry: See also Figure 1.

[SOURCE: IEC 60335-1:2020, 3.3.10, modified – Adapted for EV supply equipment.]

3.1.2

EV supply system

complete system including the DRI EV supply equipment and the EV/RESS functions that are required to transfer power between the fixed installation/supply network and the EV/RESS

3.1.3

charging

all functions necessary to condition voltage and/or current provided by the AC or DC supply network to assure the supply of electric energy to the RESS

[SOURCE: IEC 61851-1:2017, 3.1.8]

3.1.4

case A

connection of an EV to the supply network with a plug and cable permanently attached to the EV

[SOURCE: IEC 61851-1:2017, 3.1.10, modified – The figure has been deleted.]

3.1.5

case B

connection of an EV to a supply network with a cable assembly detachable at both ends

[SOURCE: IEC 61851-1:2017, 3.1.11, modified – The figure has been deleted.]

3.1.6

case C

connection of an EV to a supply network utilizing a cable and vehicle connector permanently attached to the DRI EV supply equipment

[SOURCE: IEC 61851-1:2017, 3.1.12, modified – The words "EV charging station" has been replaced with "DRI EV supply equipment", and the figure has been deleted.]

3.1.7

voltage converter

set of equipment to convert one type of electric current to another type different in nature, voltage and/or frequency

[SOURCE: IEC 60050-811:2017, 811-19-01, modified – The word "voltage" has been added to the term, and the words "static or rotating" has been deleted from the definition.]

3.1.8**voltage converter unit****VCU**

voltage converter with local EMS and communication interface

3.1.9**built-in voltage converter unit****built-in VCU**

fixed VCU intended to be installed in a cabinet, in a prepared recess in a wall or in a similar location

[SOURCE: IEC 60335-1:2020, 3.5.5, modified – The word "appliance" has been replaced with "voltage converter unit" in the term and in the definition.]

3.1.10**AUX supply circuit**

independent power supply that provides energy to a part of the components in EV supply equipment or the EV

Note 1 to entry: AUX supply circuit is used for supplying the logic controller of active and passive devices.

3.1.11**DC power circuit**

circuit for DC conductive power transfer

3.2 Insulation**3.2.1****basic insulation**

insulation of hazardous-live-parts which provides basic protection

[SOURCE: IEC 60050-851:2008, 851-15-04]
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3.2.2**direct contact**

electric contact of persons or animals with live parts

[SOURCE: IEC 60050-195:2021, 195-06-03, modified – The words "human beings" and "livestock" have been replaced with "persons" and "animals" respectively.]

3.2.3**double insulation**

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-851:2008, 851-15-06]

3.2.4**conductive part**

part which can carry electric current

[SOURCE: IEC 60050-195:2021, 195-01-06]

3.2.5**exposed conductive part**

conductive part of electrical equipment, which can be touched, and which is not normally live, but which can become live when basic insulation fails

[SOURCE: IEC 60050-442:1998, 442-01-21, modified – The note has been deleted.]